FARM INDEX

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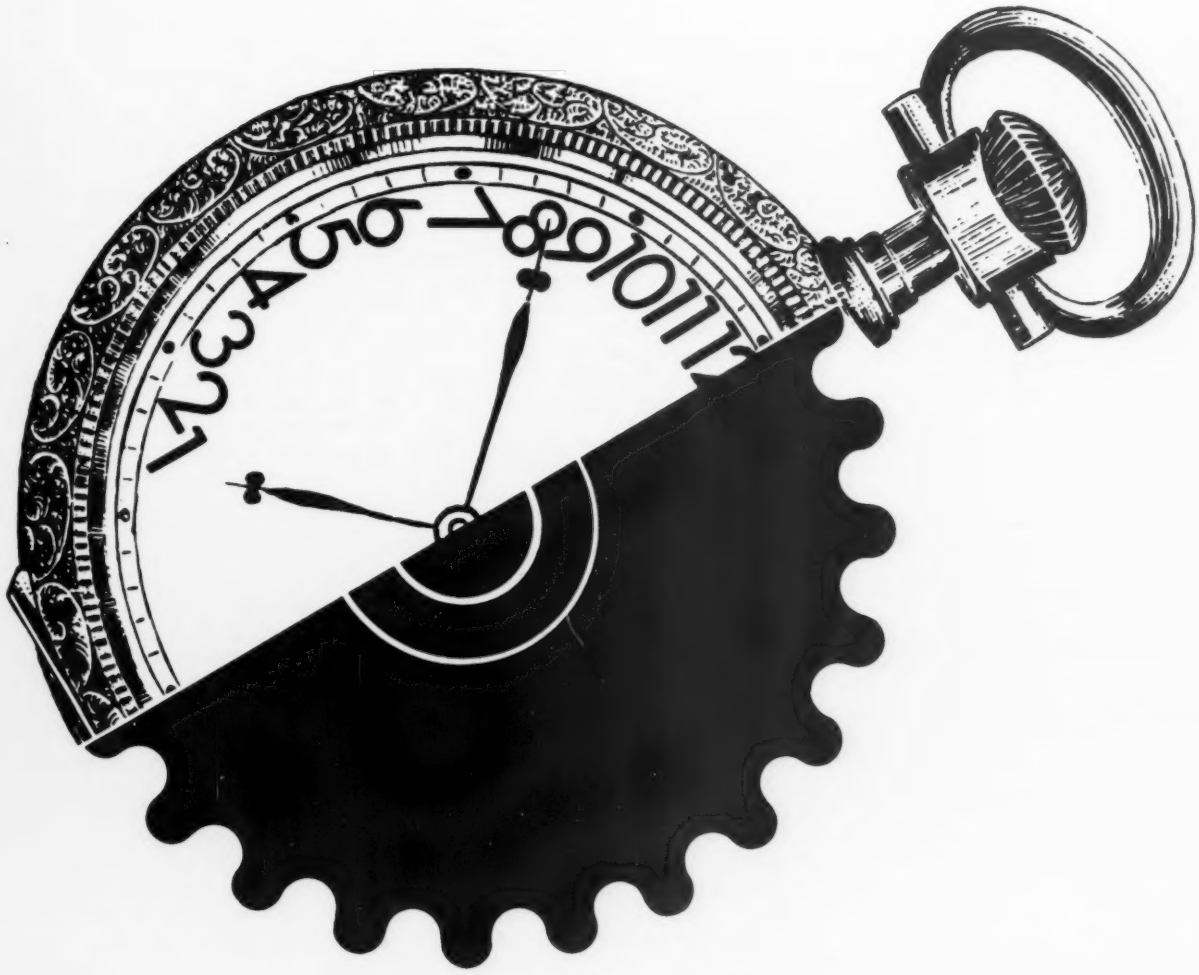
Technology Assessment: Ahead of Its Time



Outlook

Several pages in the 1976 diary of U.S. agriculture have yet to be filled in, but what's been entered so far foretells a happy ending. Returns to farmers are favorable. And the upward spiral in retail food prices is taking a breather this year.

Weather conditions will determine any twists and turns in this story between now and December. However, the mid-summer weather vane points to continued large supplies of food for home use and for export. That translates into slower advances in retail food prices.

Last year, retail food prices trotted along at a gait of 8½ percent on the average, still high by historic standards but much less than the galloping pace of both 1974 and 1973 when price increases crossed the finish line at 14½ percent.

This year, ERS economists say we can expect retail food prices to creep up by 3 to 4 percent for all 12 months, with much of the creep already behind us.

In the October-December period, retail food prices are projected to average about 2 percent higher than the same time last year. Pork and poultry tags will decline seasonally, but those for most other products derived from livestock will inch up some. Prices for crop-related foods will climb on the whole, although most of the jump will be offset by lower prices for potatoes and fresh fruits.

The near-term outlook—through summer's end—called for moderate increases in prices for dairy products, poultry, eggs, and fishery items. At the red meat counter, hikes in beef and veal were to be partly cancelled by declines for pork.

Prices for cereal and bakery products, as well as for vegetable oil prices, are apt to turn up after more than a year of stable or falling prices.

You'll also shell out more for coffee than last year. But prices for fresh fruit are expected to hover near last year's levels at this time. Fresh vegetables and potatoes are slated for price drops. Processed fruits and vegetables should remain relatively steady.

Modest though it is, that 3 to 4 percent rise in retail food costs this year can't be blamed on the farmer. The farm value of a market basket of food in 1976 may average a bit less than last year. In other words, the cost increases will have been chalked up between the farm gate and the retail outlet. The steeper prices asked for fishery products and imported foods, such as coffee, also figure on the blackboard.

Yet, the U.S. farmer will come out okay in the end. His net income for 1976 should come close to the $26 billion estimated for 1975—of itself a near record.

The Nation's farms this year are expected to gross 8 percent more than in 1975, reflecting growth in marketings of both crops and livestock products together with slightly higher prices. Total costs paid by farmers to raise those crops and livestock have gone up since last year, however, even though prices paid for certain inputs aren't advancing as fast as before. So, the modest gain in receipts for farm sales will be largely offset by total spending for the items needed to generate those sales.

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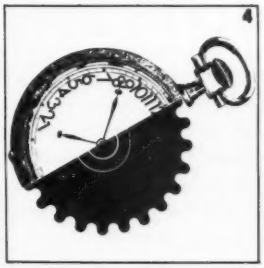

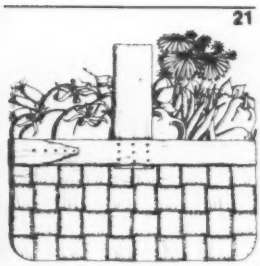

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Martin Schubkegel, Editor

Daniel R. Williamson, Associate Editor; Dorothy Mayes, Martha Newton, Staff Editors; James Schleyer, Art Director.

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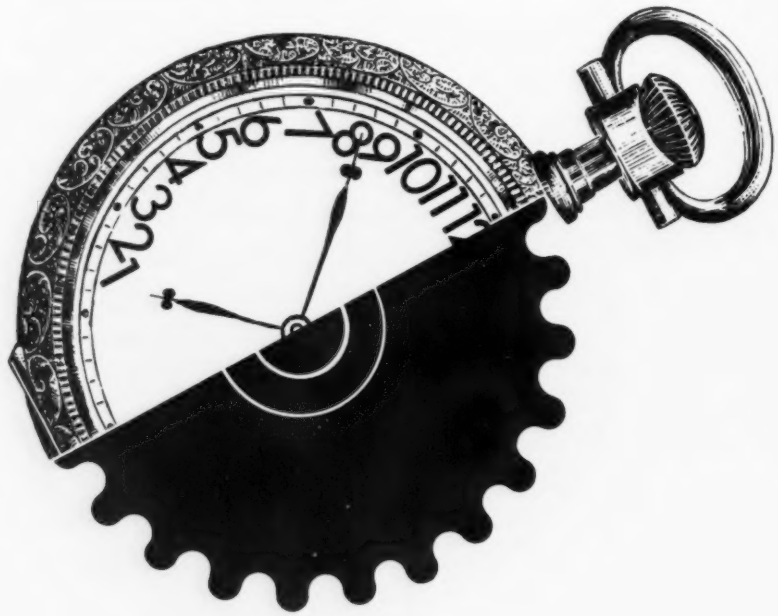
Technology Assessment: Ahead of Its Time

What is technology assessment? The following article provides an overview of this promising research method, and serves as an introduction to a special 14-page section based on talks presented at the ERS Workshop on Technology Assessment.



Inventiveness is a dominant trait in the American national character. In the Twentieth Century alone, America has produced an array of new technology that has profoundly affected mankind.

For many years, the technological development process was simple: invent it, find a market for it, and sell it. An immediate need or desire was filled, with little thought of future consequences, such as urban congestion, pollution, war, crime, and vast social changes.

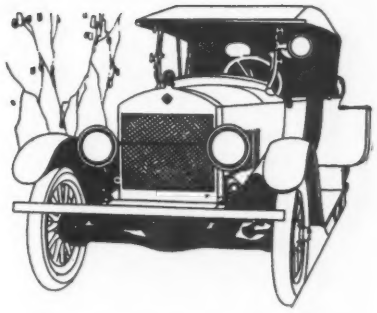
Changing attitude. Yet, in the past few years, the attitude of Americans toward new technology has changed. The concern comes from the unique role of technology in U.S. society: the scale and scope of technology, the great financial commitments to it, and the irreversible nature of much of what has already been done.

Dependence on automobiles is a good example. Despite such problems as pollution, road congestion, and economics of fuel consumption, the dependence has been set in concrete that stretches and weaves across the face of the Nation. It is bolstered by the great economic commitment of the auto industry, highway service industries, and a pyramid of related enterprises that provide millions of jobs. Moreover, the automobile is an integral part of society which Americans have shown no intention of surrendering. It is a necessity.

It is far too late to abandon the automobile. The technological impacts that followed were assured when the first cars came off the assembly line to find ready customers.

National awakening. The national awakening of concern about technological impacts is aimed at new technology, inventions, and developments which have not yet taken root in American society.

This new concern was apparent in opposition to the supersonic transport (SST) and to the Alaska pipeline.



ERS conference. From this growing concern a demand for *technology assessment* (TA) has risen. Recently, ERS sponsored a Technology Assessment workshop in Washington. Joseph F. Coates of the Office of Technological Assessment, U.S. Congress, was a speaker. ERS is now preparing to incorporate TA approaches in its research involving agricultural technology

Technology assessment may be defined as "policy studies examining the fullest range of impact of the introduction of a new technology or the expansion of a present technology in new or different ways," according to Coates.

In making TA, researchers should expect that:

- Decisions, including a possible choice of abandoning the project, will be made based on TA findings.
- The study should be aimed at informing decisionmakers about the alternative actions and probable consequences.
- Historical experience may be a useful tool in TA, but it is only a partial guide to effects of a new technology. For example, the automobile is not well modeled by horse and buggy.
- Unknown aspects of the technology must be presented to decisionmakers along with known aspects.
- Long-range indirect and unanticipated effects of a technology are often more significant than the immediate, planned consequences.

Looking beyond. With this in mind, "TA must go far beyond conventional engineering and cost studies to look at what else may happen in achieving an immediate goal, to the total range of social costs, the impacts on the family, on legal, political, and social institutions, on the environment, on international relations, on land-use planning, on the structure of cities, and on the makeup of populations," Coates said.

A major problem confronting the efforts in TA is two broad fears that have been expressed about it:

Large bureaucracies suspect that TA may be an effort to undermine the economic development and growth of the Nation.

Many concerned citizens suspect that TA may be an elaborate government and industry whitewash.

Pluses prevail. Instead of these possible perversions of the TA tool, advocates contend that these benefits are more likely to occur:

1. A project may be modified to lessen undesirable side effects. For example, if a new manufacturing process would release a pollutant into a river, steps can be taken to reduce or eliminate the pollutant. When incorporated into the initial design, such modifications are normally cheaper than if added on later.

2. Specifications for monitoring a program can be established if there is uncertainty about its effects. A weather modification program may be conducted under such monitoring if research is unable to clearly determine long-range effects.

3. Research and development may be stimulated by TA. If an effect of a program may be adverse, then efforts may be made to find solutions or, if the effects are too negative, the program may be delayed as researchers seek alternatives.

4. New benefits may come from TA, which would otherwise be overlooked. For example, the creation of dams was a beneficial project on many rivers. The spinoff effect was the creation of large lakes behind the dams that have become recreational bonanzas. TA could identify such benefits at an early stage and allow them to be exploited quickly.

5. Gaps in regulatory systems may be lessened through TA. The present governmental regulatory apparatus may not be able to adjust to many new technologies until ill effects have already been felt. TA can anticipate such ill effects and help close the gap.

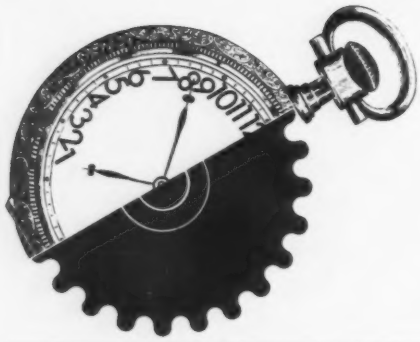
6. TA can identify legislative needs. Basic legislation may need to be passed to set up new regulatory arrangements to control new technology.

7. New institutions can be facilitated by TA to control new technology. TA can identify rising needs to create new institutions.

8. Intervention experiments may be sparked by TA. A new form of public housing may be planned, for example. A TA assessment may disclose several major unpredictable possible effects. With this uncertainty, the program may be delayed as small-scale experimental applications are tried and assessed, before a costly, widespread commitment is made.

9. Projects may be delayed until effects are fully explored. However, as planners become more accustomed to incorporating TA at early stages, delays should become rarer in years ahead.

10. Basic information would be compiled for the American public



which would aid in decisionmaking in the American political system. This should benefit both sides of a given issue in reaching an acceptable decision.

Agricultural application. The application of TA to U.S. agricultural production processes may be especially critical, in light of the world's dependence on American food production.

While perhaps less dramatic than the creation of atomic bombs or great new modes of travel, agricultural technology's impact on the world may be as great, with an increasing need for more and more innovations to meet the world's food requirements.

In 1970, an American agricultural scientist wrote, "Continuing development and application of technology in production of food, fiber, and forest products can supply the next generation abundantly. It can enable them to take the actions necessary to have clean air, sparkling water, and a green and pleasant world in which to live."

Two years later, a critic of agricultural research said, "In terms of wasted lives, depleted rural areas, choked cities, poisoned land and maybe poisoned people, mechanization research has been a bad investment."

Somewhere between these conflicting opinions lies a vast area in which TA can be applied.

Historic trend. Historically, Americans have been quick to design better methods of agricultural production. Yet, an offsetting, balancing characteristic is the cautious nature of farmers, who adopt the new techniques only after careful thought, much scrutiny, and, more often than not, overriding economic considerations.

A look at the long list of technological improvements to agriculture produced by Americans is staggering. Such machines as the cotton gin, the mechanical reaper, plow improvements, the tractor, many types of cultivators, and today's great combine machines have turned agriculture into a vast commercialized operation. American researchers have also led the way in developing new hybrids, chemical fertilizers and pesticides, and processing and distribution systems.

Far-reaching impacts. Individually, each technological innovation produced a range of impacts. Together, the innovations revolutionized agriculture with far-reaching effects throughout the world.

Perhaps a classic example of the effect of technological development is the story of Eli Whitney's cotton gin. When Whitney designed the machine in 1793 to separate lint from seed, it made possible a great new textile industry in the South that brought vast new wealth to farmers there.

The immediate effect was beneficial, yet long-range effects were disastrous.

Slavery spinoff. The extensive commercial production of cotton led to the expansion of the plantation system, which used slave labor. The South became economically dependent on the plantation system, thus setting the stage for the Civil War. Without Whitney's invention slavery could have declined and disappeared, and the Civil War could have possibly been averted.

Of course, the tragically negative long-range effect of the cotton gin is not reflective of most agricultural innovations. In fact, the thrust of agricultural technological development has been critically beneficial. It largely enabled U.S. wheat production to increase from 313.7 million bushels in 1875 to 2.2 billion bushels last year. In the past 25 years alone, wheat yields per acre have doubled, and other crops have improved similarly. At the same time, less manpower is required to produce more food. Last year, there was 1 farmer for every 53 Americans. This compares with 1 farmer for every 16 Frenchmen and 23 West Germans. The Soviet Union has 1 farmer for every 5 people.

Complex problems. With this technological bonanza comes an array of complex problems. Machines require fuel, yet America faces fuel shortages. Machines emit polluting exhausts. Machines displace workers, thus causing social change. Chemicals affect ecology, and present a special need for caution when applied to foods for human consumption.

As American agriculture gears up to meet the increasing food needs of the Nation and the world, improved technology is essential. Yet, it is perhaps equally essential to exercise technology assessment so that many of the consequences can be foreseen before innovations are applied.

[Based on the paper, "Technology Assessment," presented by Joseph E. Coates, Office of Technology Assessment, U.S. Congress, and material by Wayne D. Rasmussen, National Economic Analysis Division, at the ERS Technology Assessment Seminar, Washington, D.C. in April 1976.]

ERS Sees Wider Role in Technology Assesment

Should ERS do more work in technology assessment? Quentin M. West, ERS Administrator, dealt with this question in a talk at the ERS Workshop on Technology Assessment. Here is a synopsis of his speech.

As an agency, ERS must develop and disseminate economic information to be used by public and private decisionmakers who are concerned with the allocation and use of resources in rural America.

This mission is carried out in various ways:

- Developing and maintaining national and worldwide estimates of current resource use and availability, output, and distribution of food and fiber.
- Identifying interrelationships among economic forces, institutions, and Government policies and programs affecting resource use, production, and distribution.
- Developing short-term forecasts and long-range projections of resource use, production, and distribution for both probable and possible events.
- Evaluating the performance of the food and fiber sector in meeting the needs and wants of the consumer and the goals of society concerning such matters as quantity and quality of goods and services, income and income distribution, and quality of life.
- Identifying future adjustments in the food and fiber sector and evaluating their economic and social impacts on all segments of society.

ERS responsibilities. In short, ERS is responsible for monitoring the progress, evaluating the impacts, and charting and predicting the course of that most basic segment of the economic system—food and fiber.

With these broad responsibilities in mind, ERS's relationship to technology and research on technology assessment becomes clear. Technology assessment is "the formal systematic examination of existing, newly emerging, or prospective technology with the objective of estimating first and second order costs and consequences over time in terms of the economic, social, demographic, environmental, legal, political, and institutional dimensions of the impacts of technology."

Technology. Technology is a "prime mover" in economic progress and evolution, introducing constant change in the stream of economic activity as new technology is adopted and old technology is abandoned. No other factor has done more to shape the structure of the existing food and fiber system or influence the outcome or performance of that system. Technology creates a situation where basic materials are more efficiently used, thus allowing for the release of resources into the development of secondary and tertiary industries—characteristics of a healthy economy.

Other interests. ERS is also interested in technology assessment because of the crucial problems affecting both the U.S. and the world economy: the need to increase production and resource use to feed the world's rapidly growing population and to boost productivity in the distribution system to lower the costs of exchanges; to conserve energy and develop new energy sources; and to protect the environment. Solutions must be sought through new technological advances, and ERS must take a substantial and expanding role in assessing their consequences.

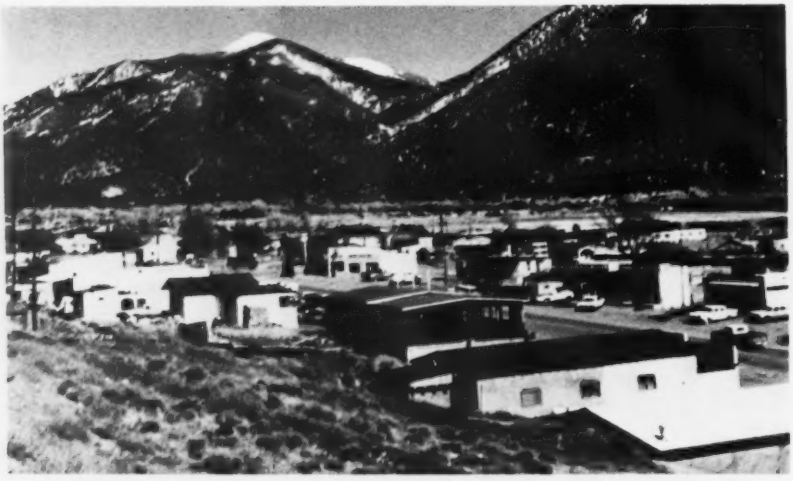
Interagency cooperation. Such assessments require interagency cooperation within USDA. ERS and the Agricultural Research Service have conducted joint research on certain aspects of technology. However, an enlarged cooperative effort is needed to identify new technology for solving problems within the food and fiber system, to assure that special interest groups' concerns can be addressed through factual information, and to provide an early warning system to avoid major adverse consequences of new technologies.

Expanded program. As resources become available, the ERS program will be expanded to serve the following purposes:

- Identify gaps in technology within the food and fiber system, thus helping to insure that needed innovations come on stream to meet human needs and goals of society.
- Facilitate effective monitoring of ongoing research and development activity.
- Provide early warning signals of problems ahead that would be associated with particular technological activities and which may warrant the development of countervailing technology or of other solutions.
- Inform potential users of their opportunities for net gains and of benefits and costs likely to accrue to others as the technology is adapted.
- Inform those likely to experience the indirect impacts about the nature, timing, and magnitude of those impacts.
- Inform public officials about how the new technology, if adopted, would impact on various local, State, and national objectives.

Coal Development Spells Rural Problems

Technology has had profound impacts on society. The potential usefulness of technology assessment may be seen in the following five articles that provide examples of the impact of technology on society.



The rapid, unplanned growth of rural communities can be a costly experience.

What happens when a small agricultural community suddenly becomes the setting for a large-scale coal mining operation? Is prosperity just around the corner? Not necessarily.

A recent research project by ERS, the Environmental Protection Agency, and several universities indicates that the costs to the community could outweigh the benefits.

Specific objectives of the project, which aims to nail down the impact of coal mining on certain communities in the Northern Great Plains, are to develop and test methods for estimating population, employment, income, and fiscal changes in localities affected by coal development.

Intensified mining in Fort Union Region. The Fort Union Region of the Northern Great Plains—which includes sections of Wyoming, Montana, and North Dakota—was selected for the study because it contains almost half of the Nation's mineable coal resources. This area has been the scene of intensified mining in the last few years, primarily because of sharp hikes in the price of coal—from less than $6.50 per ton in 1970 to $15 in 1974.

The region is composed mainly of sparsely settled agricultural communities. Over the last 34 years, total population has expanded slowly, with cities growing, farms declining, and small towns staying about the same. The population was 444,000 in 1974.

Numerous problems. The rapid unplanned growth of these communities can cause numerous local problems. Some individuals and communities are trying to slow development through the use of taxation, zoning, subdivision regulations, siting authorities, and water rights laws.

The creation of a new coal industry requires a large work force. Manpower requirements during construction are as high as 200 for a mine, 1,500 for a generation plant, and 3,000 for a gasification plant. Construction may take up to 2 years for an export mine, and 3-5 years for a conversion plant. Manpower needs for operation are about half those for construction.

Indirect demand for labor. In addition to the basic construction and operation work force, an indirect demand for labor arises for supplying the industry with inputs and marketing services, and for delivery of consumer goods and services.

The majority of the new labor force consists of persons who migrate to the area. As a result, local wages increase to the levels necessary to attract and maintain the supply of labor needed for the new industry and community services.

Since many workers may live in areas adjacent to the community with the new industry, the impacts of such developments are far reaching. On the whole, large cities can absorb a new industry much better than small rural towns, because they already have most, if not all, of the needed community services.

Big difference. ERS's coal impact assessment project has been underway about a year. Results to date indicate that local governments are likely to experience wide disparities between revenue flows and expenditures.

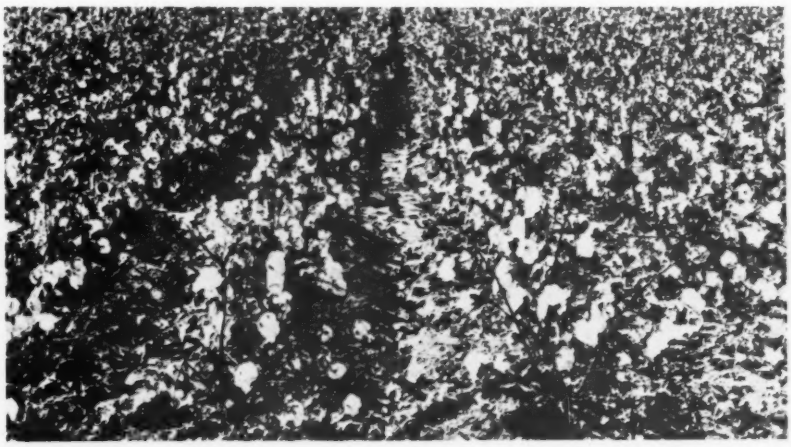
[Based on "Local Community Impact of Coal Mining in the Northern Great Plains," speech by Lloyd D. Bender, Economic Development Division, Montana State University, Bozeman, Montana.]

USDA Plots New Attack on Boll Weevil

Ask a cotton farmer what his No. 1 problem is and he'll probably tell you it's a quarter-inch critter commonly known as the boll weevil.

This pest arrived in the U.S. from Mexico around the turn of the century, and by 1927 it had infested 14 of the 17 cotton-producing States. Since its arrival, the boll weevil has eaten away at growers' cotton and their income. Estimated yield losses and weevil control costs now total more than $250 million each year.

USDA has initiated a plan—which may cost as much as $50 million—to evaluate alternative boll weevil control technology.



The boll weevil costs farmers more than $250 million each year.

Three options. The objective is to provide information to the Secretary of Agriculture, Congress, and cotton producers to help them decide whether to implement an eradication program throughout the Cotton Belt; support a beltwide optimum pest management program that can maintain the boll weevil population below economic damage levels; or continue with current practices.

Today, most cotton farmers protect their crops from the boll weevil by repeated applications of insecticides to the fruiting cotton plant. This strategy assures a late-season boll weevil population buildup, and, unfortunately, a perpetuation of the cycle.

Eradication to be tested on 30,000 acres. The eradication experiment, which will be conducted on 30,000 acres in the Carolinas and Virginia for 3 years beginning January 1977, will involve various chemical, biological, and cultural control practices. Costs versus benefits are anticipated to be high during the eradication phase. Afterwards, maintenance control costs should be minimal compared to the profits.

The objective of the optimum pest management trial, also to run for 3 years, is to establish that the boll weevil and other pests can be maintained below economic damage levels through the use of integrated pest control techniques and the voluntary participation of growers in a community-wide program. Although the site hasn't been chosen, the experiment will be conducted on 25,000 acres in one or more Cotton Belt counties.

Results applied to entire area. Results of the large area trials for eradication and optimum pest management control technologies will be applied to the whole Cotton Belt; a control group of cotton producers using current control practices will be identified for each of the programs. In addition, data will be collected from a sample of growers throughout the Cotton Belt to more accurately characterize current practices and technologies.

Each trial area and control group will be monitored annually for information on costs and benefits and control effectiveness to provide a basis for comparison and to enable the Secretary of Agriculture to decide at the end of each year whether to continue the trials. At the conclusion of the 3-year trials, a final evaluation will determine which of the three packages—eradication, optimum pest management, or current practices—should be continued.

Final analysis. The analysis will consist of economic, biological, and environmental evaluations and an overall examination of tradeoffs. As yet, preliminary plans have not considered institutional and social implications of the alternatives.

[Based on "USDA Evaluation of Boll Weevil Control Technology," speech by Velmar W. Davis, Natural Resource Economics Division.]

Tobacco Industry Pushes Toward Mechanization

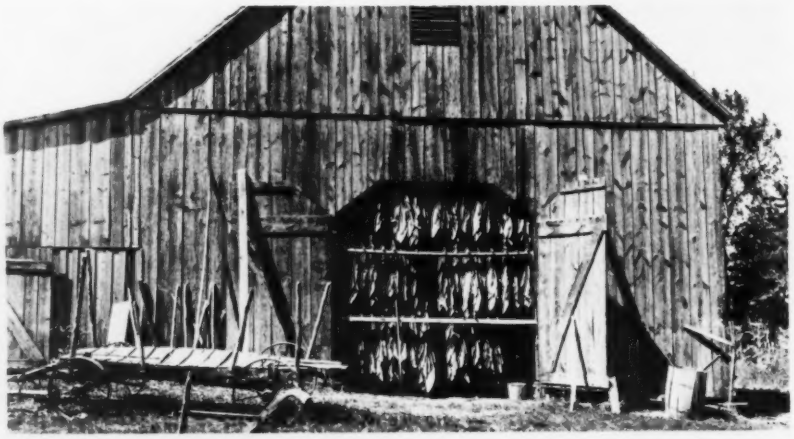
From now until 1980 hundreds of thousands of workers in flue-cured tobacco farming may have their employment reduced by mechanization. Most will be youths and women.

These are some of the findings of a study on adjustments to mechanization in the flue-cured tobacco industry being conducted by ERS, the U.S. Department of Labor, and North Carolina State University.

Throughout the remainder of the 1970's, mechanization will continue to expand, with a shift toward more bulk systems and mechanical harvesters. In a bulk system, the tobacco leaves are pressed together in bales and brought into barns for curing. It requires fewer workers than the conventional method, in which individual leaves are hung for curing. Mechanical harvesters are used only with bulk systems, but bulk systems may be used without harvesters.

Bulk systems to grow. In 1972 bulk systems were used for about 8 percent and mechanical harvesters for about 1 percent of the tobacco crop. By 1980 this could jump to 62 and 30 percent, respectively, assuming wage rates increase 50 percent relative to other prices and tobacco production expands 50 percent over 1972. Under low output conditions—which assume 1980's output would be half that of 1972's—the figures would be 65 and 21 percent.

Job opportunities lost under such a scenario range from 266,000 for low output to 84,000 for high output over the 8-year period, or 72 to 23 percent. Worker displacement would be spread, though not evenly, over about 200 counties. For the most concentrated production region, the Coastal Plain of North Carolina, the reduction could average almost 800 harvest jobs annually per county.



Conventional tobacco curing methods are giving way to more mechanization.

Mechanized jobs favor males. Opportunities for jobs with mechanized systems such as bulk rackers, barn loaders, and barn unloaders tend to favor males because of the physical stamina required. Although most of these jobs can be, and sometimes are, done by women, survey results show that in 1972 males did 80 percent of the harvest work for bulk barn systems, compared with 61 percent for conventional systems.

It also seems likely that job losses would fall heavily on seasonal hired workers, as opposed to family and regular hired workers. Seasonal hired workers did 75 percent of the handing, 74 percent of the hand looping, and 63 percent of the tying machine work in 1972—major jobs associated with conventional systems not needed with bulk systems. Moreover, family and regular hired workers would probably have priority for jobs with mechanized systems.

Harvest wages. In 1972 earnings from tobacco harvest work averaged $346 with over 80 percent of the workers making less than $500. For three-fourths of the workers, these wages constituted more than 75 percent of their total earnings.

The study has yet to determine how seriously the job opportunity losses would affect household earnings. Earnings from harvest may be all of an individual's earnings, though they may represent a small part of his or her family's earnings.

The study is also examining the implications of lost job opportunities for youths, since the average age of harvest workers is 26 with over half under 18.

[Based on the speech, "The Flue-Cured Tobacco Study: Development Strategies Project," by Owen K. Shugars, Commodity Economics Division, and Lon Cesal, Economic Development Division.]

4-Wheel Drive Adds New Dimension

Horsepower has been important to farmers since the first day a horse was hitched to a plow. However, instead of counting horsepower in one's and two's, today's farmer might be counting to 140 plus.

Tractors, of course, have been the reason for the phenomenal boost in power. And the 4-wheel drive type—on the market just since the 1960's—has made some of the bigger engines more feasible.

Traction power. With driving power distributed to all four wheels, greater traction is possible so that a tractor can handle more horsepower. Put another way, as the horsepower increases for a conventional 2-wheel drive unit, so does the wheel slippage, thus wasting some of the power.

And there's no doubt about it, more farmers are demanding greater horsepower. For one thing, as farms get larger, greater efficiencies in time and money are possible. Also, the move to minimum tillage equipment calls for more pulling power.

As a result, during 1970-74 the 4-wheel drive types went from 1 percent of tractor sales to over 4 percent. This is a dramatic increase, but it's also obvious that the conventional 2-wheel drive tractor hasn't lost a whole lot of ground.

Longrun costs. Despite the physical advantages of 4-wheel drive, there is one big drawback—cost, both the price tag and operating expenses. Are the higher costs worth it in the long run? ERS set out to answer that question.

And perhaps more important, ERS wanted to see what "hidden costs" may be involved if more farmers adopted the 4-wheel drive tractor. That is, the impact the newer technology would have on farming and the whole society.

Questions ERS asked were: Would farm size be more likely to increase? Would the demand for farm labor decrease? How would the farm machinery industry be affected?

For the initial study area, ERS chose the dryland farming regions of Washington State, northern Oregon, and bordering Idaho counties. Later, similar studies will be conducted in the Great Plains and the Corn Belt.

Acreage figures. Several sizes of conventional and 4-wheel drive tractors were considered. And it was observed that for all tractor sizes, machinery costs decrease per acre as the acreage increases.

However, a 4-wheel drive tractor only surpasses the economies for a smaller tractor on larger acreages. For example, study results show that 900 acres must be covered before a 228 drawbar horsepower (dbhp) 4-wheel drive tractor becomes more cost efficient than a 90 dbhp conventional crawler tractor.

Time is a big part of the savings. Using the same size implement—a 4-bottom plow—the 4-wheel drive model can plow approximately 400 more acres in the same amount of time than can the smaller conventional tractor.

Word of caution. A word of caution to the farmer enticed by saving time, hence labor costs, with a 4-wheel drive tractor: Unless he is planning on expanding his farm sufficiently or has a large enough acreage that the dollars saved on labor would offset increased machinery costs, he had best stick with his conventional tractor. Otherwise, he could wind up with higher per acre costs.

In the study area, only one-third of the farms expanding in size (from at least a base of 700 acres) could economically handle the 4-wheel drive. Of those farms large enough to really consider 4-wheel drive (at least 1,500 acres), 5 out of 9 could save money with the bigger tractor.

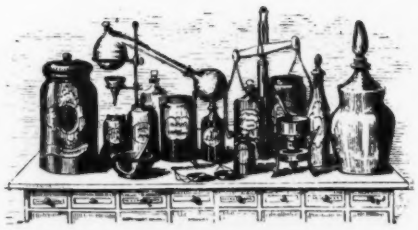
Overall impact. What would be the overall impact of such a switch in the study area? The demand for agricultural labor would drop by as much as 4 percent. But savings in yearly production costs—which would eventually be passed on to the consumer—could amply make up for the economic impact of the displaced workers.

The potential yearly reduction in machinery operating costs in the study area is estimated at $7.5 million if farm operators in the area were to switch to the 4-wheel drive tractor where economically feasible. About $1.4 million, or 18 percent of the savings would be from reduced labor costs (assuming labor is valued at $4 an hour).

Also, there would be a potential drop in the demand for farm tillage implements and conventional tractors, which is estimated at about $15 million over the 10-year period covered by the study's projections. Reduced expenditures of this magnitude could affect the size and location of implement dealers.

[Based on "Technological Innovation and Diffusion: Case of the Four-Wheel Drive Tractor—Some Initial Findings," speech by Gordon E. Rodewald, Jr., National Economic Analysis Division, stationed at Washington State University.]

Food Technology Sparks Concern



Would you believe that before the day's end, 20 new food forms will have been developed. And by the end of the week, 140?

Food technology is progressing at about that rate, which totes up to 7,200 new forms a year. And that's for the retail market alone. Various other food products are being continually changed or developed for the industrial and institutional markets.

Lest you envision pictures of supermarkets bursting at the seams, however, many of these kinds of foods—which are themselves often variations of existing products—merely replace some of the foods already on the shelves. Also, some of the new foods fail to pass the test of consumer acceptability—in either appeal or price or both—so they quickly fade from the market.

So why all these new foods, most of which are highly processed? That's a question many people have been asking, and depending on their vantage points, coming up with different answers.

Food industry's stand. Let's look at the issue first from the food industry's position.

A food processing firm has a big stake in developing new products, for the food processing industry is a $62 billion market. Any new food which can garner another piece of that market for the firm is, from a business angle, very desirable. Also, the more foods a firm has available to consumers, the greater the brand name exposure and hence, a greater chance of brand loyalty.

Furthermore, the food processors feel they are doing a service for consumers by offering products with superior convenience, quality, taste, freshness, availability, and variety over the current foods offered on the market.

And the industry argues that it is responding to a consumer demand for more convenience foods. To back up this stand, it points to rising consumer incomes and changing lifestyles which trend away from extensive food preparation at home to fast and easy highly processed foods or even eating out.

Consumer reservations. But some consumers and researchers are having reservations about such contentions. Much more is at stake, they say, than the business angle.

For example: What about the effect on food prices? Do benefits outweigh environmental hazards?

Specific impacts of concern are:

- Higher food prices, hence increased inflation.
- Greater consumer confusion and concern over what is actually in food.
- Nutritional deficiencies or hazards—reduced intake of valuable trace elements and increased intake of potentially health-endangering chemicals.
- Influence on lifestyles—i.e., decline in family mealtime, etc.
- Increased use of energy and nonrenewable resources.
- Waste disposal and pollution problems in processing plants.
- Possible unemployment in the food and fiber sector, leading to increased compensation and welfare payments.
- Greater concentration and market power in the food industry.

Corrective actions. Is something being done about any of these concerns? From a consumer viewpoint, yes.

The industry shows signs of being more selective in making new market introductions. Since roughly 4 out of 10 new food products fail at the marketplace, the industry is imposing stiffer standards of new products in an effort to curb capital losses—losses which the consumer usually has to absorb in the form of higher food prices.

Nutrition and food safety are also receiving increased attention, as the more highly processed foods often contain various chemical additives. In fact, the average person eats more than 5 pounds of chemical ingredients in 1 year. Recent watchdog efforts of consumer groups and the FDA have uncovered potential cancer carcinogens and chemicals with other undesirable effects, such as Red Dye #2, linked to hyperactive behavior in children.

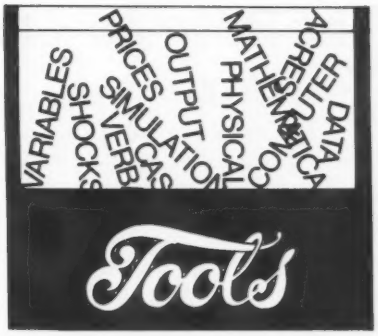
Along the lines of energy conservation, new technology may offer energy-saving alternatives to frozen highly processed foods. Such an alternative could be the retort pouch—a flexible laminated pouch that combines the advantages of the metal can and the plastic boil-in bag, but with much less energy required in production and no refrigeration needed for the final product.

Ultimately, the consumer holds the power of the purse strings—what he or she buys determines the market mix. And consumers have shown increasing concern over exactly what their food dollars are getting them, both price and nutrition-wise.

[Based on "Potential Assessment of Changing Technologies in Food Forms," speech by Larry Traub, National Economic Analysis Division.]

The Researcher's Toolbox:

Delphi panels, statistical methods, input-output analyses, linear programming, computer models, and scenarios . . . the list goes on. Here we pick from the toolbox two implements few researchers could do without.



Simulation Models

Economist, physicist, sociologist, or psychologist—every analyst at one time or another has reached for "simulation models" in his box of tools for research.

The simulation model is among the most versatile of implements, and has been used for decades to explain an astonishing variety of situations. But not till the 1950's and the computer age did models establish a secure niche in the researcher's tool box. The lightning speed of a computer makes possible the complex assignments that can be made by simulation models.

Multiuses. Computer models have been constructed for such varied situations as water supply management, hog farrowing, global warfare, and neurotic behavior. The range and scope of simulation is limited only by the know-how and imagination of the analyst, and by the availability of data.

A widely used definition of simulation is "the representation of the essential elements of some state of affairs over time." The representation may be physical (e.g., a model aircraft used for wind tunnel tests), verbal (a description of some manufacturing process), or mathematical for analysis by computers.

A simple illustration of a computer model: An economist wants to define the factors that determine the acreage farmers plant to wheat, with the idea of using the model to project wheat acreage in the future. So he constructs a series of equations with all the variables that he believes might affect wheat acreage, such as wheat price in a previous period, output, fertilizer price, and so on.

Checking the model. Then the researcher checks out the model to see how close it comes to reality. If the model is valid, then farmers in a previous period would have planted approximately "y" acres of wheat when the price of wheat was "x^1" and cash receipts were "x^2", etc. Every equation of the model is tested, and adjusted until the model conforms with reality.

A "finished" simulation model has several features that make it an attractive tool for technology assessment (TA). First, simulation provides the scientist with a laboratory for performing controlled experiments and recording results. By altering the variables and data of the basic model, the scientist may trace the likely impacts throughout the system. For example, if certain pesticides were banned, what would happen to farmers' costs, to production levels, and ultimately to food prices at the supermarket.

Snapshot approach. Another advantage: Simulation creates a series of "snapshots" of a process. Each snapshot provides data for use in future snapshots, thus enabling the TA analyst to gauge the effects of actions over any period—a day, a month, a season, or a year.

Simulation also permits its users to evaluate the impact of certain events based on their probability of happening. It's possible to build into the model what economists call "shocks"—sudden changes in technology or technique that might throw the basic model out of kilter.

This is not to say that simulation models by themselves can do the whole job of TA. Other techniques must be brought into play to insure adequate problem definition, correct formulations, and good results.

As one economist put it: "The computer does not provide a magic cure for foggy problem definition, fuzzy goals, or a scanty data base. Good analysis or bad, good data or bad, it's all the same to the machine."

Not a panacea. Simulation doesn't negate the need for a reliable knowledge or data base, careful statement of the problem, and clearly stated objectives. "Simulation," the economist continues, "is not a panacea but a powerful tool to complement creative analytical thinking."

Also, simulation models can be big and expensive. Their strength lies in addressing complicated matters; they are often inappropriate for more simple situations where standard techniques would do.

Finally, the group preparing the TA should be prepared to devote considerable effort for extended periods as the models are developed and modified.

Simulation's future? Developments in this area will probably have less to do with new computer techniques, and more to do with combining simulation with other analytical methods.

[Based on "Application of Simulation Models to Technology Assessment," by Theodore Thornton, National Economic Analysis Division.]

The Researcher's Toolbox:

Scenario Writing

William Shakespeare's observation that "All the world's a stage, and all the men and women merely players," may take on special meaning to ERS economists involved in TA.

The economists will weave elaborate "scenarios" (a theater term) of possible and alternative chains of events either stemming from the implications of new technology, or leading to a possible outcome.

While lacking the Bard of Avon's majestic prose, the ERS scenarios may be vital tools in assessing the broad impacts of a given technological development. And, on that world stage, the leading role is more likely to be given to a contraption or a chemical than to the men and women players.

Scenario defined. In the framework of technology assessment, a scenario is a consistent, well researched and detailed set of circumstances that is sufficiently plausible to allow the reader to understand the situations, conditions, and strategies that prevail.

Scenarios can be used to answer two kinds of questions:

- How might a given situation occur in the future, step by step, from the present?
- What alternatives exist for each "actor", at each step, for preventing, diverting, or facilitating the process?

The emphasis is on the word "process" because a scenario encompasses all stages of the process—not just one phase. A scenario is a motion picture, not a snapshot.

Either direction. Scenarios can be constructed either toward an "alternative future" (possible end result) or from it. A forward direction scenario may address this question: "If we keep going at this rate, where will we end up?" Or, "I wonder what would happen if . . ."

Reverse scenario may start with a desired future situation and work back to the present, identifying each decision point in the path to that future. By anticipating these branching points and choosing correctly, players can increase the chances of achieving the desired future.

To set the stage for using a scenario, let's look at the playbill: Scenarios focus on *actors* who, when involved with *events*, are faced with *choices*, and must make *decisions*, which lead to *consequences*. The cycle repeats itself throughout the scenario.

Applying to economics. The application of scenario writing to economic analysis offers a researcher a means of examining theory, as well as data, in a disciplined, practical manner. An analysis of known data, by itself, severely restricts research into the future. To look several years ahead requires the application of theory in the form of scenario writing.

Scenario writing at the outset of a policy analysis provides the researcher with a framework for research that follows, and it helps him view the future in concrete terms—not as a projection of data. After the research is completed, the scenario format provides a clear, comprehensive means of presenting the findings to the public or to other decisionmakers.

Minimum tillage study. USDA used elements of the scenario approach in a technological assessment of minimum tillage. The study traced interactions and problems that might occur as minimum tillage becomes the dominant tillage technology. Although it stopped short of providing policy options relevant to minimum tillage, the report has been widely acclaimed.

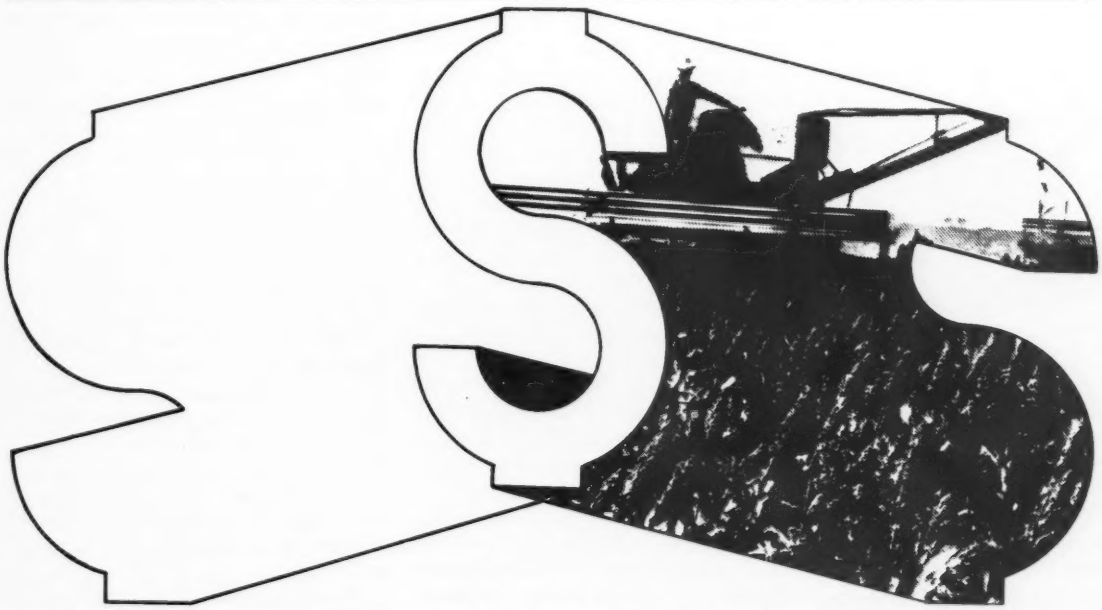
On the surface, it may be easy to mistake scenario writing for fortunetelling. To many people, attempts to peer into the future have a vaguely unscientific aura. Yet, a thin but important difference exists between fortunetelling and scenario writing:

A scenario is like a vast roadmap that may show policymakers many routes to travel. The choosing of the route is left up to the public, or the decisionmakers, who will be able to make those choices armed with the best available information.

Based on the paper, "Use of Scenario Writing in Assessing Technology," by A. Barry Carr, Congressional Research Service, Library of Congress.

The Tools at Work

Solving the complex problems of American agriculture often demands that economists employ a number of research tools in tandem. Projecting agriculture's productivity is a prime example.



U.S. agriculture's track record for strides in productivity has long been the envy of many industries, yet the search for even greater milestones goes on. While research scientists work in the fields and laboratories, economists work in offices and computer centers to judge the likely impacts of emerging technologies and other forces behind the ever-rising spiral of agricultural productivity.

Recent study. In a recent study, ERS economists concluded that between 1980 and the year 2025, farm productivity could about double under specified conditions. Analysts made their projections using several research tools, including statistical methods, simulation, and just plain "professional judgment."

Statistical methods were used to get the parameters (variables) for the simulation model, and the possible paths of growth in productivity were simulated under alternative scenarios. The Delphi (panel) technique and the "relevance tree" method were used to obtain data on emerging technologies in agricultural production.

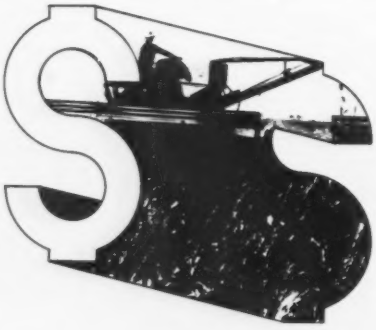
Logical route. It sounds complicated but it isn't. The map from question to answer follows a logical route.

First step: Construct the productivity change simulation. That means economists must determine the reasons for changes in agricultural productivity and how they relate to one another.

Productivity gains are explained by advances in technologies; improvements in farmers' skills; changes in prices farmers get and receive; public policy and programs; weather; and regulations controlling how we use the environment—controls over pesticide use, feedlot runoff, and so on.

The most important factor contributing to long-term growth in productivity was found to be technological change, and the development of new technologies depends on investment in scientific research.

The ERS study suggests that "among the forces influencing agricultural productivity growth, research and education (R&E) expenditure is the most important variable which the policymaker can most easily control."



Second step: Estimate the parameters, or variables, of the simulation models. The economists examined data from 1939 to 1972. They looked at the productivity index, R&E spending, the education index for farmers, and the weather index.

Top of recipe. R&E and education again came out near the top in the recipe for increasing agricultural productivity.

Every dollar invested in R&E this year would yield a total of $4.30 over the next 13 years in added production from increased productivity. And over the long pull, for every year's increase in the average schooling of farmers we would see an annual gain in productivity of about 12 percent.

Weather conditions were rated as being crucial to stepped-up farm productivity, although weather is important only when explaining year-to-year swings. In 3 out of 10 years in the 1939-72 period, weather variations accounted for more than 1.5 percent of the average annual change in agricultural productivity.

Third Step: Establish a simulation model under alternative scenarios. For the education index and for weather factors, economists pretty much called on previous data to project what might happen in the future. For the R&E expenditures, however, they picked out five different levels of spending for the 1980-2025 period. Changes for each level of spending were combined with the predictions for changes in the education index and in weather in order to project productivity.

Spending level. Economists speculated that the most likely level of R&E spending would be that which occurred during 1939-72—or, 3 percent growth per year. This would result in an increase in agricultural productivity of roughly 60 percent between now and 2025.

Fourth Step: Identify emerging technologies. So far in this exercise, the economists assumed that in years hence there would be new technologies coming along to replace or to improve on existing technologies. But this is not the same as assuming technological breakthroughs.

Will there be major breakthroughs by the year 2025 in agriculture? What are the chances of a particular technology becoming available for adoption by a specific year? How fast will farmers take to it? Finally, what will be the repercussions on crop and livestock production?

The answers. In the last analysis, economists narrowed down the possible emerging technologies to three which would have unprecedented impacts on agricultural productivity:

1. Twinning in beef cattle: multiple births.

2. Bioregulators: natural and synthetic compounds that when applied to crops before harvest will advance ripening and their ability to withstand the rigors of mechanical harvesting, especially for fruits and vegetables. After harvest, bioregulators will prolong shelf life and reduce cooling cost.

3. Enhancement of photosynthetic efficiency: among other things, speeding up the process by which plants make proteins, and speeding their growth rates in general.

Fifth Step: Evaluate the impacts of emerging technologies. To get a good fix on the situation, the economists had to weigh the possibilities that the above three technologies would become commercially available in a future year, and they had to estimate their rate and pattern of adoption by farmers as well as the specific crops and livestock to be affected.

Productivity soars. If, and that's a big "if," all three breakthroughs were to be adopted during 1980-2025, agricultural productivity would shoot up an estimated 34 percent. That would be equal to a productivity gain worth some $12 billion by the year 2025 in 1957-59 constant dollars.

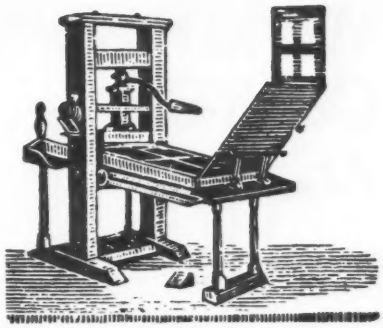
Adding that 34 percent to the 60 percent mentioned earlier would result in a near doubling of U.S. farm productivity within less than 50 years.

Economists who did this study probably wouldn't stake their fortunes on the eventual outcome. However, these are the best estimates they can offer in 1976, based on the best collection of research tools yet available.

[Based on "Impacts of Emerging Technologies on Agricultural Productivity Projections," paper by Yao-chi Lu, National Economic Analysis Division.]

Recent Publications

Single copies of the publications listed here are available free from The Farm Index, Economic Research Service, Rm. 1664–So., U.S. Department of Agriculture, Washington, D.C. 20250. However, publications indicated by (*) may be obtained only by writing to the experiment station or university. For addresses, see July and December issues of The Farm Index.



Production Costs and Consumer Acceptance of Dried-on-the-Vine Raisins. Robert V. Enochian, Mary D. Zehner, Stanley S. Johnson, and Vincent E. Petrucci, National Economic Analysis Division. AER-337.

Due to high labor costs of hand picking ripe grapes and drying them in the sun, alternative raisin-producing methods are being sought—one of which is inducing the grapes to dry on the vines. However, this report shows that this method is still costlier than the natural way, although it's cheaper than yet another way—the continuous tray method. The study results also indicate that dried-on-the-vine (DOV) raisins would probably find a favorable consumer response. However, some consumers might balk at the color variations in the DOV raisins.

Analyzing the Feasibility of Rural Rental Apartments in the Great Plains: A Guide for Local Decisionmakers.

Joseph R. Schmidt and Gerald A. Doeksen, Economic Development Division, Stationed at Oklahoma State University; Jack Frye, Extension Service; and John C. Maxey, Farmers Home Administration.

A budget analysis is developed which can aid in evaluating proposed rental apartments in rural areas. The analysis uses average construction and operating costs computed from data obtained from FmHA on existing rural rental units in western Oklahoma. Alternative apartment sizes, types of structure, and rental rates are evaluated.

Managing Buffer Stocks To Stabilize Wheat Prices. Jerry A. Sharples, Rodney L. Walker, and Rudie W. Slaughter, Jr., Commodity Economics Division. AER-341.

A wheat buffer stock simulation model is used to add random deviations of wheat yields and exports to projected supply and demand conditions for 1976-82. The result is a useful analytical tool for policy analysis—especially for the analysis of questions about price and income stability where deviations of production and use from the mean, rather than the value of the mean, are of primary interest.

Impact of Earned Income Tax Credit: A Simulation of 1976. Thomas A. Carlin, Economic Development Division. AER-336.

According to this simulation analysis of the 1976 tax year, families living in the South could receive over 43 percent of the benefits from earned income tax credits—refundable tax credits enacted into law as part of the Tax Reduction Act of 1975. About 34 percent could go to families in rural areas and almost 7 percent to farm families. The law, in effect through the first half of this year, may or may not be extended to cover the whole year.

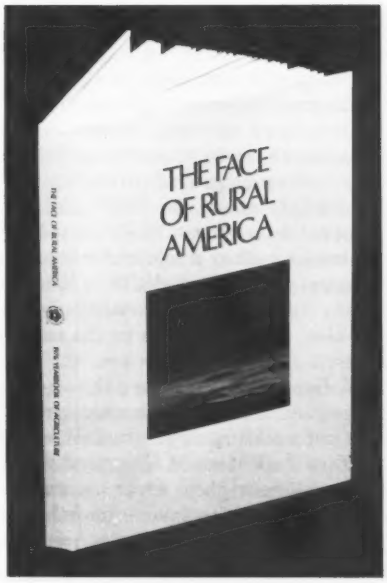
1976 Agriculture Yearbook

The Face of Rural America, the 1976 Yearbook of Agriculture, gives a panoramic view of modern farming. Its 335 photographs—in large picture book format—center on farming, farm families, and country living as it is in the Bicentennial year.

Over 50 photographers across the Nation have captured typical rural America at work and play. The photos, along with their captions, are particularly geared to explain to nonfarmers what today's farming is really like.

Congress receives over 233,000 copies of the Yearbook, with some available for free distribution. So check with your Congressman or Senator for a copy. If none are left, however, you can get the Yearbook for $7.30 from Government bookstores across the country. Or send a check or money order to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

The Department of Agriculture produced the book, but has no copies for public distribution or sale.



World Poverty: Can It Be Abated?

The story of poverty in a developing African nation is told in cold statistics that have chilling meaning in terms of human suffering.

Chad, a former French colony, has a gross national product of about a quarter of a billion dollars. Average life expectancy is 31 years, and infant mortality rate is about 16 percent. About 95 percent of the people live in rural areas. Illiteracy is 90 percent. Per capita income is less than $100 a year. Chad is among the least developed nations of the world.

For Americans, this depth of poverty is perhaps beyond imagination. For economists who try to develop schemes for improving living conditions of the world's poor, the statistics are a source of anguish and frustration that progress is so slow.

Growing poverty. Despite all efforts to devise economic systems to help, great poverty not only lingers in developing nations, it actually seems to be growing in many areas.

Developed nations, especially the U.S., have made intensive efforts to spur economic growth in developing nations to raise the GNP and per capita incomes. The long-held rationale is that a spurt of economic development will result in a "trickle-down" of income to the impoverished masses, relieving some of the suffering.

Yet, recent studies have shown that benefits from such economic growth are not trickling down. In fact, some studies indicate that the standard of living for the poor actually deteriorates with such growth, as prices rise while incomes remain pitifully low.

Lecture to economists. ERS economists, whose work often has implications for developing nations, recently heard an ERS Bicentennial Lecture Series talk by a University of Maryland professor of economics who is an authority on economic growth in developing nations. She discussed the findings of three studies of economics of developing nations:

- A cross-section statistical study of differences among countries in relative income sharings of the poorest 60 percent of households.
- A historical analysis of poverty in the mid 19th century when Europe's "industrial revolution" was beginning.
- An economic model for the South Korean economy which was used as a theoretical base to test policies and programs of development.

Common conceptions err. According to the lecturer, the three studies puncture many common conceptions about development.

The cross-section study generally underscores the complexities of the task of helping the poor:

Contrary to popular belief, higher rates of industrialization, faster increases in agricultural productivity, and higher rates of economic growth all tend to shift distribution of income away from the poor and toward the elite minority—at least in the short run.

Instead of a trickle down, the spurt of growth trickles up to the already wealthy.

The study declared, "The path toward sustained economic growth is eventually blocked unless either the country is sufficiently large or redistributive policies are sufficiently important to generate an internal market for growth."

Bleak outlook. In short, for most of the poorer developing nations, the outlook for the impoverished majority may be bleak.

If a nation moves beyond this stage of growth in which the small elite

class soaks up benefits of growth, then its middle-income group benefits most from the growth that follows. Yet, the position of the poor continues to worsen as they are still unable to keep pace with resulting price increases.

Even if the nation reaches the highest development levels possible for a developing nation and establishes widespread economic growth in many areas, the poorest segments benefit only when a concerted effort is made by that nation to share the growth by involving the poor in the economic development.

Slim chance. The cross-section study concluded that, to even have a chance of reaching the poorest segments, a nation must be among the most economically advanced of the world's developing nations.

With this dismal picture of the problems of helping the poor people of developing nations, the lecturer suggested that the answers to the problems would require vast changes in development policies, and in the political, economic, and social structures of most developing nations.

Perhaps a glimmer of hope can be found in the histories of the world's great developed nations. Deep and widespread poverty was very common in Western nations in the mid-19th century as industrialization began. The historical study examined the poverty structure in 24 countries in 1850, and it revealed great income distribution gaps.

Poverty in 1850. In 1850, poverty was most widespread in India and China where a swelling population combined with a trend of fragmenting the land into tiny lots through inheritance. The technology to work the land also lagged, and parcels grew ever smaller.

Poverty was least widespread among newly settled countries, such as the U.S., where great resources and expanding frontiers provided an outlet.

In the middle ranges of national poverty, extreme poverty was greatest where economic and demographic change had been widespread or very rapid.

Population in nonindustrial Scandinavian countries surged faster than employment opportunities to create masses of landless unemployed or underemployed laborers. In Great Britain, industrialization did not absorb surplus population.

The study drew several conclusions:

- In nonindustrial nations, degree of poverty hinges on the ratio of resources to population, and the structure of land ownership.
- Extreme poverty is possible under both high and low levels of development.
- Any economic structural change such as industrialization, tends to increase poverty among poorest segments, especially in early stages of rapid development.

The importance of the landholding structure in nonindustrial nations is exemplified by Spain and Italy in 1850. Much of the land was owned by a few people, but cultivated by small-scale tenants. Landowners raked off large profits, leaving tenant farmers impoverished.

Change may hurt. A conclusion with severe implications to today's developing nations is that many economic structural changes hurt the poor. When the old structure is displaced, a painful transition occurs. People are forced out of old enterprises before the new system can accommodate them.

In an industrializing nation, a small-scale handicraft worker who provided a product in a trade that had been passed down from generation to generation suddenly found himself competing against a factory that made the same product at much cheaper, mass-production cost. The handicraft worker was quickly thrown into poverty.

Peasants dispossessed. In an agrarian nation, a peasant farmer found himself barred from the commonland field that his family had farmed for centuries. Rising land values and rents added to the painful squeeze. The shift to production for markets led to debts and, finally, dispossession of his own land as he had no resources to ride out market fluctuations.

When economic growth occurred, it wasn't uniform in all areas of a country. Labor shortages existed in some areas, while gluts were in others. People were reluctant to leave ancestral lands to migrate, thus they accepted lower pay to remain on small plots of land.

Women and children work. Even if a peasant lived in an area of industrial development, he could face poverty and frustration, as factories hired only a small portion of the labor force. Available jobs often went to women and children—cheaper labor. The unskilled labor demand drove down earnings. Thus the husband, who was ex-

pected to perform the breadwinning role, often watched in anguish as his wife and children worked long hours as he was forced to be idle.

The study concludes: "We found no automatic trickle down to the poorest segments of population of the benefits of industrialization."

South Korean model. The economic model for South Korea produced still other discouraging prospects for developing nations. Researchers tested many policies and programs through the model and found a very strong tendency for effects of such schemes to fade quickly, with the economy returning to the same levels that would have been reached without the plan.

If a single policy were tried alone, it rarely produced a lasting effect. Sizable, lasting gains were achieved only when several schemes were applied together at the same time to produce a change in the overall development approach.

Thus, a change in economic structure is needed to improve the position of the poor, and that change must be made as part of a concerted push by the government to help the poor.

Vital factors. The South Korean model stressed agricultural terms of trade and extent of rural to urban migration vital factors in antipoverty policy.

Once again, many popular concepts failed to pan out in the study.

By themselves, promotion of small-scale industry and changes in labor intensity of manufacturing fail to directly help the poor.

Policies that tip benefits of agricultural trade to help incomes of small farmers and landless laborers are the most effective, even though they hurt urban poor. Gains to rural poor are greater than the losses to the urban poor.

Income transfers. Another antipoverty measure is direct transfers of income to the poor or, in a variation, price subsidies for necessities. Such transfers work effectively in the short run, but the effects are eroded over time. As incomes rise, portions spent on necessities drop. Moreover, effects last only as long as the program exists, thus entailing a perpetually large welfare budget, and a constantly large number of people assigned to welfare roles.

Single strategies. Many single urban programs are, at best, only moderately effective. In many countries, more effective urban programs are public works efforts in construction and transportation, and intensified promotion of labor intensive and export industries.

Overall, the best approach in helping the poor in a developing nation is a "combined intervention strategy" that mixes several single policies together, aimed at both rural and urban development.

"Market socialism" is one major variation of a combined strategy approach. Researchers modeled a strategy after approaches tried in noncommunist socialist countries. Market socialism included land reform, nationalization of large industries and import substitutions, as well as public works, rural cooperatives, and industrial decentralization.

Reform capitalism. "Reform capitalism" was modeled as an alternate approach. A capitalistic nation would make an intensive effort to alleviate poverty by altering the structure of society. This package included many of the same components as the "market socialism" effort, except for emphasizing promotion of labor-intensive exports instead of import substitution, and introduction of rural marketing boards and agricultural productivity improvements, instead of land reform.

Both alternatives were effective. Despite leakages to upper classes in reform capitalism, and growth rate decline in market socialism, each method helped the poor.

After a decade, the population as a whole would be better off under reform capitalism. But the poor are still better off under the socialistic package, than if no antipoverty measures had been taken.

Complex task. The three studies examined in the lecture served to underscore the difficult and complex task of using the few effective strategies to help the poor in a developing nation.

Developing nations must somehow reach a level of development that will allow the application of a balanced mix of strategies with the cooperation of a government that is strongly committed to help the impoverished majority.

[Based on the paper, "Policies for Equitable Growth in Developing Countries," presented to the Conference on Economic Development and Income Distribution at the Institute of Behavioral Science at the University of Colorado, April 1976, by Irma Adelman, Cynthia Taft Morris, and Sherman Robinson; and a lecture from that paper by Dr. Adelman presented May 17 at the ERS Bicentennial Year Lecture Series, Washington, D.C.]

All About Home Gardening

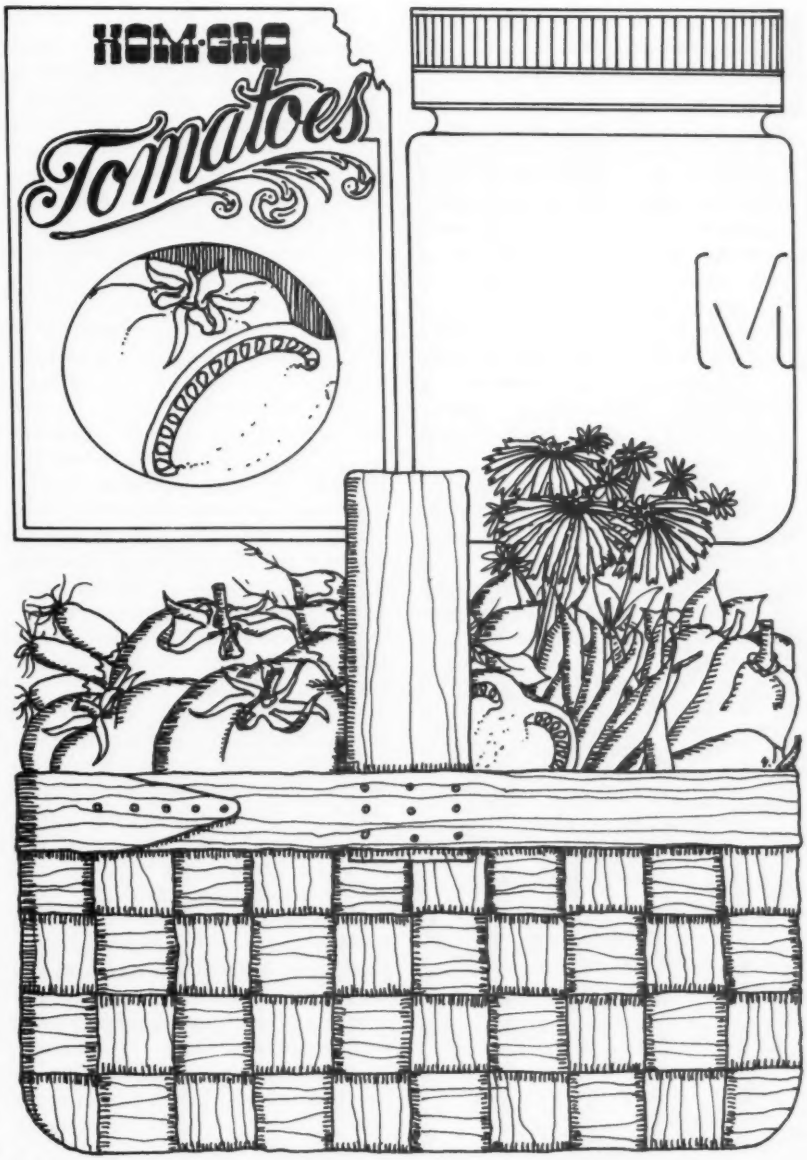
An ever-increasing number of Americans are digging up their backyards each summer to make room for neat rows of tomatoes, beans, cucumbers, peppers, strawberries, apples—some of the fruits and vegetables they love best.

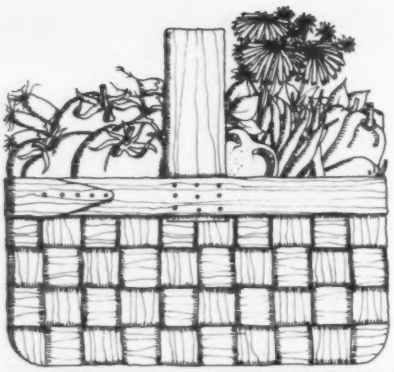
Why do they do it? Why don't they just buy these items at the nearest supermarket and save themselves the time and trouble?

According to a recent national food study being conducted by Response Analysis Corporation of Princeton, New Jersey, under contract with USDA, about half the home gardeners in 1975 grew their own produce because they say it tastes better than what's available in supermarkets. Others took up gardening because it cuts down on their food budget, while another large group did it as a hobby.

Growing interest. Whatever their reasons, the interest in home gardening is growing. Of the nearly 1,400 households in the survey (home gardening is only one of eight areas being investigated in this far-reaching study of consumers' behavior, attitudes, and motives toward food), 48 percent had, or intended to have, a fruit and vegetable garden this year, up from 43 percent in 1974 and 46 percent in 1975. Some of these were obviously one-time gardens, as only 34 percent of the households had gardens all 3 years. In comparison, 42 percent of the households did not have gardens at any time during the 3-year period.

Population statistics. Demographic characteristics, such as region of the country, size of the household, rural vs. metropolitan area, and household with or without children, seemed to

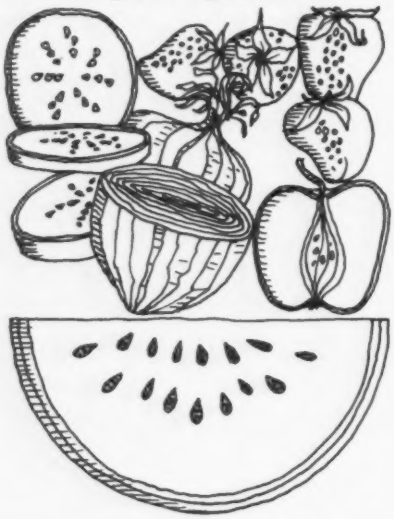




play a role in determining which households had a garden in 1975 for economic reasons or as a hobby.

For example, households in rural areas and those with five or more members were more likely to have had a garden to save money or cut down on the food budget than households in metropolitan areas or with fewer members. In contrast, households in rural communities and those with children under 6 years of age were less likely to have a home garden as a hobby. Such characteristics did not seem to determine the number of households that had a garden because they liked the taste of fresh fruits and vegetables.

Most gardens in household yard. About 85 percent of the 1975 gardens were located in the household yard, suggesting that most of these respondents owned their own homes. Nearly 86 percent of all homeowners who had gardens planted them in their own yards. The study did not determine the location of the remaining home gardens, but it might be assumed that they were probably on a free community plot, since nearly all those surveyed whose household gardens were some place other than their own yards said there was no payment for the use of their garden location.



Not surprisingly, the hottest item on the home gardener's list was the tomato—about 95 percent of the households grew this vegetable in 1975. Beans (limas, green, wax, pole, etc.) were the next most frequently grown vegetable—by about 70 percent of the home gardeners—followed by cucumbers, peppers, radishes, and green onions with 60 percent, and lettuce, onions, corn, and carrots, 50 percent.

Fruits not as popular. Fruits were not as popular with the 1975 gardeners. Only about 20 percent grew strawberries and apples, while another 10 percent planted melons, peaches, and pears.

Most of the households that had home gardens in the study year extended the life of their crops through freezing and canning. Nearly 70 percent froze some fruits and vegetables, with 10 percent of the respondents claiming this was one of the reasons for the household garden.

More beans found their way into freezers than any other vegetable; they were frozen by about half the home gardeners. Corn was next at 40 percent, followed by peppers, peas, and tomatoes, about 30 percent. Strawberries and apples were again the most popular fruits, frozen by 16 and 11 percent of the households, respectively.

Separate freezers aid to some households. Not unexpectedly, households with separate freezers froze more fresh fruits and vegetables in 1975 than those with ordinary refrigerator/freezer combinations, probably because they had more room to store the frozen items. For example, three-fourths of the households with separate freezers froze some fresh produce, compared to less than half of those with refrigerator/freezer combinations.

About 30 percent of the 1975 garden households canned fruits and vegetables from their home gardens; 14 percent said this was one of the reasons they had a garden. Tomatoes, canned by 65 percent of the households, and beans, by 42 percent, were the leading vegetable candidates, followed by cucumbers and beets, about 30 percent. Of the fruits, apples led at 15 percent; next were strawberries, pears, and peaches, 10 percent.

Shortage of canning materials. Difficulty in obtaining lids, jars, and other things needed for canning in 1975 caused 17 percent of the canning households to freeze some fruits and vegetables that they ordinarily would have canned. Twenty-five percent of the respondents from households that canned despite the difficulty said less fruits and vegetables were preserved by this method than under normal conditions.

[Based on a speech, "Results from the 1976 USDA National Survey on Home Gardening," by Evelyn Kaitz, National Economic Analysis Division, presented at the American Seed Trade Association's 93rd annual convention, Los Angeles, California, June 30, 1976.]

Economic Trends

[1]Ratio of index of prices received by farmers to index of prices paid, interest, taxes, and farm wage rates. [2]Average annual quantities of farm food products purchased by urban wage earner and clerical worker households (including those of single workers living alone) in 1959-61—estimated monthly. [3]Annual and quarterly data are on 50-State basis. [4]Annual rates seasonally adjusted second quarter. [5]Seasonally adjusted. [6]As of March 1, 1967. [7]As of March 1, 1975. [8]As of November 1, 1975. [9]Beginning January 1972 data not strictly comparable with prior data because of adjustment to 1970 Census data.

Source: U.S. Dept. of Agriculture (Agricultural Prices, Foreign Agricultural Trade and Farm Real Estate Market Developments); U.S. Dept. of Commerce (Current Industrial Reports, Business News Reports, Monthly Retail Trade Report and Survey of Current Business); and U.S. Dept. of Labor (The Labor Force and Wholesale and Consumer Price Index).

Item	Unit or Base Period	1967	1975 Year	1976 June	1976 April	1976 May	1976 June
Prices:							
Prices received by farmers	1967=100	—	186	186	189	191	195
Crops	1967=100	—	201	198	193	198	209
Livestock and products	1967=100	—	172	176	186	185	184
Prices paid, interest, taxes, and wage rates	1967=100	—	181	183	193	193	195
Family living items	1967=100	—	166	166	174	174	175
Production items	1967=100	—	182	186	197	196	199
Ratio[1]	1967=100	—	102	102	98	99	100
Wholesale prices, all commodities	1967=100	—	174.9	173.7	181.3	181.8	—
Industrial commodities	1967=100	—	171.5	170.7	180.0	180.4	—
Farm products	1967=100	—	186.7	186.2	192.9	192.6	—
Processed foods and feeds	1967=100	—	182.6	179.7	178.0	179.9	—
Consumer price index, all items	1967=100	—	161.2	160.6	168.2	169.2	—
Food	1967=100	—	175.4	174.4	179.2	179.9	—
Farm Food Market Basket: [2]							
Retail cost	1967=100	—	173.6	172.9	174.9	175.2	—
Farm value	1967=100	—	187.0	190.3	184.1	182.3	—
Farm-retail spread	1967=100	—	165.1	161.9	169.0	170.7	—
Farmers' share of retail cost	Percent	—	42	43	41	40	—
Farm Income: [3]							
Volume of farm marketings	1967=100	—	115	99	90	92	—
Cash receipts from farm marketings	Million dollars	42,817	90,572	6,651	6,118	6,300	—
Crops	Million dollars	18,434	47,327	3,101	2,012	2,200	—
Livestock and products	Million dollars	24,383	43,245	3,550	4,106	4,100	—
Realized gross income [4]	Billion dollars	49.9	99.2	101.1	—	—	—
Farm production expenses [4]	Billion dollars	38.2	75.5	74.9	—	—	—
Realized net income [4]	Billion dollars	11.7	23.7	26.2	—	—	—
Agricultural Trade:							
Agricultural exports	Million dollars	—	21,894	—	1,932	1,848	1,824
Agricultural imports	Million dollars	—	9,328	—	896	848	1,020
Land Values:							
Average value per acre	Dollars	[6]168	[7]354	—	—	—	[8]381
Total value of farm real estate	Billion dollars	[6]181.9	[7]370	—	—	—	[8]398
Gross National Product: [4]	Billion dollars	796.3	1,498.9	1,460.6	—	—	—
Consumption	Billion dollars	490.4	963.8	950.3	—	—	—
Investment	Billion dollars	120.8	182.6	161.4	—	—	—
Government expenditures	Billion dollars	180.2	331.2	324.7	—	—	—
Net exports	Billion dollars	4.9	21.3	24.2	—	—	—
Income and Spending: [5]							
Personal income, annual rate	Billion dollars	626.6	1,245.9	1,245.2	1,346.2	1,357.2	—
Total retail sales, monthly rate	Million dollars	26,151	48,702	48,578	53,300	52,644	—
Retail sales of food group, monthly rate	Million dollars	5,759	10,977	11,023	11,314	11,296	—
Employment and Wages: [5]							
Total civilian employment	Millions	74.4	[9]84.8	[9]84.5	[9]87.4	[9]87.7	[9]87.5
Agricultural	Millions	3.8	[9]3.4	[9]3.4	[9]3.4	[9]3.3	[9]3.3
Rate of unemployment	Percent	3.8	8.5	8.7	7.5	7.3	7.5
Workweek in manufacturing	Hours	40.6	39.4	39.3	39.4	40.2	40.2
Hourly earnings in manufacturing, unadjusted	Dollars	2.83	4.81	4.78	5.07	5.12	5.15
Industrial Production: [5]	1967=100	—	118	116	129	129	—
Manufacturers' Shipments and Inventories: [5]							
Total shipments, monthly rate	Million dollars	46,449	82,724	81,039	93,848	94,511	—
Total inventories, book value end of month	Million dollars	84,655	146,574	148,059	148,121	149,166	—
Total new orders, monthly rate	Million dollars	46,763	81,351	79,789	94,141	96,048	—

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